COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
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Robert G. Burnley
Director

Gerard Seeley, Jr.
Piedmont Regional Director

December 29, 2005

King William County
Kennington Subdivision
Pump Station

Jim Duke
Rodgers – Chenault, Inc.
7240 Lee Davis Road
Mechanicsville, Virginia 23111

Dear Mr. Duke:

This Office has received plans and specifications, as prepared by Timmons Group, for the referenced facility. The plans entitled "Kenningnton, Well House and Sewage Pump Station, Acquinton District, King William County, Virginia" include 34 sheets and are engineer stamp dated December12, 2005. The specifications entitled "Kennington Sewage Pump Station, Force Main & Waterline, Project Manual, Technical Specifications, King William County, Virginia" are engineer stamp dated December 19, 2005.

The project consists of 10,500 linear feet of 8-inch and 2200 linear feet of 10-inch force main and a duplex, submersible pump station. Each pump will be rated at 390 gallons per minute at 215 feet TDH. The project will serve a subdivision consisting of 229 single family homes, 172 town homes, and office and retail space. The County of King William will own the sewage facilities.

The facility has been designated Reliability Class II. The facility meets requirements of this reliability class by the use of a standby generator.

The evaluation of these plans and specifications has been confined to technical requirements and design criteria, as stipulated in the Commonwealth of Virginia *Sewage Collection and Treatment Regulations*.

King William County
Kennington Subdivision
Pump Station

In accordance with Virginia Water Control Law, *Code of Virginia*, 1950 as amended in Title 62.1, Section 62.1-44.19, this letter report is to advise that the previously mentioned plans and specifications are technically adequate and are approved by this office with the condition that an Operations and Maintenance Manual is submitted for approval by the Department Of Environmental Quality before issuance of a Certificate to Operate.

Please be aware that disturbance of any streams and/or wetlands may also require permitting. If you believe that this may be the case, please contact the Regional DEQ Office at (804)-527-5038 for further information on the permitting process.

One set of the previously described plans and specifications with Virginia Department of Environmental Quality approval stickers is enclosed.

Once the project is completed, this Office will need a statement of completion from the licensed engineer who oversaw construction of the project. At that time, this Office will initiate the certificate to operate process.

For the Director, Department of Environmental Quality

Sincerely,

Raymond R. Barrows, Jr.,P.E.
Area Engineer
Office of Wastewater Engineering

J. R. Bell Jr., DEQ-PRO
Curtis J. Linderman, DEQ-PRO
Reuben Varghese, M.D., M.P.H., Director, Three Rivers Health District
Frank A. Pleva, Administrator, King William County
James C Pyne, Ph.D., P.E., HRSD
Ginastyo Mutoti, P.E., Timmons Group

rev 12/22/05 +

10/01

PUMP STATION REVIEW FORM

Page 1 OF 4
Date 8/8/05
Reviewed By: RRB

Project: Kennington

REQUIREMENT	REFERENCE	COMMENTS
Location of Pump Station King William County		
* Buffer zone: 100' ±	sh 2	100' recommended
* Station Protected from 100-year flood: 86 vs 85.8	calc pg 8	
* Fully operational during 25-year flood:		
All-weather access road provided: yes	sh 4	

RECEIVING FACILITIES accepted by King William

Capacity of receiving sewer line _____ MGD		Adequate?
Capacity of receiving pump stations _____ MGD		Adequate?
Capacity of receiving STW = _____ MGD _____ STP average flow (1 yr.) _____ MGD		Adequate?

PRETREATMENT

Discharge piping designed to prevent grit from settling in lines of pumps not in operation: (Y)/N — sh 5

Briefly describe any pretreatment provided: (restaurants must have a grease trap)
none

PUMPING UNITS

Type of Pumps Provided submersible

Number of pumping units provided: 2 — minimum of 2

Pump No.	Friction Head (ft)	Static Head (ft)	Rated Capacity (gpm)	Rated TDH (ft)	Operating Capacity (gpm)	Computed TDH (ft)	Variable Constant Speed
1-2	11.71 *	177	393 *	195	393	214	C

STATIC HEAD: -

Project: Kennington

PUMP STATION REVIEW FORM

High point elev:
LWL elevation: _____

RESIDUAL HEAD: -

C = _____

FRICTION HEAD; -

EQ LENGTH OF PIPE, ft

APPERTENANCE: _____

see attached

Friction losses:

FLOW (gpm)	RES + STATIC HD (ft)	FRICTION LOSSES (ft)	TDH (ft)	velocity (fps)	loss/100' (ft)

Plot FLOW against TDH on the next page (pump curve).

The pumps will operate at 393 gpm vs. 214 feet TDH,
to 551 gpm vs. 186 feet TDH.
powered by a _____ HP electric motor.

REQUIREMENT	REFERENCE	COMMENTS

Is capacity of pumping equipment adequate? (Y)N)

10/d1

PUMP STATION REVIEW FORM

Page 3 OF 6
Date 8/8/05
Reviewed By: RKB

Project: Kennington

Can peak flow be pumped with largest unit out of service? (Y/N)

Alternating control: yes — spec 13709 - 1.04

Type of control mechanism: float switch — sh 5 — Adequate?

Controls adequately protected from the weather: (inside or NEMA rated: 4X) — spec 13709 - 2.01

Individual suction and intake lines: _____ — N/A

Suction line size _____ inches — N/A — 4-inch minimum

Velocity (range) in suction line _____ fps — N/A — 2 to 6 fps

Discharge line size 8 inches

Velocity (range) in discharge line 1.74 - 2.17 fps _____ 2 to 8 fps

2 x 6, 2.5 x 4

Are line sizes and velocities adequate? (Y/N)

Is gate valve provided on each suction line? (Y/N) N/A

Gate valve and check valve on each discharge line? (Y/N) sh 5 — both on each line

Size of spheres that pass through pump 3 inches — 11312 — minimum 3" diameter. Can pass 2" if a ≤ 2" bar screen is provided

If less than 3 inches, explain: _____

SUBMERSIBLE PUMP STATIONS

Provisions for pump quick disconnect & reconnect: yes — sh 5 — for small stations

Hoist and accessories: yes — sh 5

Shut-off & check valves located in a separate vault? (Y/N) — sh 5

SUCTION LIFT STATIONS

Net positive suction head requirements met? (Y/N)

Gate valve provided on suction line? (Y/N)

Air relief piping on pump discharge line? (Y/N) — min. 1.25" diameter

Pumps, shutoff, & check valves located outside wet well?

Separate access to wet well provided? (Y/N)

REQUIREMENT	REFERENCE	COMMENTS
WET WELL		
Is there mechanical equipment/screens which requires personnel to enter the wet well? (Y/N)		If yes, there must be mechanical

PUMP STATION REVIEW FORM

Project: Kennington

Date 8/8/05

Reviewed By: RRB

If "No", is a 4-inch downward-facing, screened vent provided? (Y/N) — ah 5 — ventilation

Volume from LWL to rim = _____ cu. ft. (next page)

Ventilation fan capacity _____ cfm

Air changes per hour _____
(30 air changes/hr minimum for intermittent operation)
(12 air changes/hr minimum for continuous operation)

air changes/hr = $\frac{\text{fan capacity} \times 60}{\text{volume}}$ = $\frac{(\quad \text{cfm}) \times 60}{(\quad \text{cu. ft.})}$ = air changes/hr

Is ventilation adequate? (Y/N)

Fan of non-sparking variety? (Y/N)

Adequate access provided? (Y/N) — to pull equipment

Adequate lighting provided? (Y/N) — to work at night

Wet well fillets provided? (Y/N) Slope 1:1 — minimum of 1:1

Wet well divided? (Y/N)
If "yes", properly interconnected? (Y/N)

Volume between LWL and pump 1 on = 2115 gallons

Is design adequate to prevent both pump from overheating due to excessive starts and septic conditions due to excessive detention time? (Y/N)

DRY WELL

Adequate access provided? (Y/N)

Provisions for removing equipment? (Y/N)
Describe _____

Sump pump provided? (Y/N) — Back to wet well and down towards the water level
Discharge point _____

Volume of dry well = _____ cu. ft.

Ventilation fan capacity _____ cfm

Air changes per hour _____
(30 air changes/hr minimum for intermittent operation)
(12 air changes/hr minimum for continuous operation)

air changes/hr = $\frac{\text{fan capacity} \times 60}{\text{volume}}$ = $\frac{(\quad \text{cfm}) \times 60}{(\quad \text{cu. ft.})}$ = air changes/hr

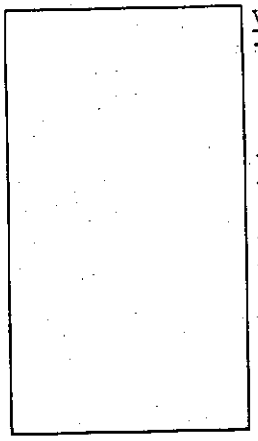
Is ventilation adequate? (Y/N)

Wetwell:

Project: Kennington

PUMP STATION REVIEW FORM

Date 8/8/05
Reviewed By: RKD



VOLUME:
--Ground = 86.5

-- Inlet = 75
--Alarm = 74.5

--Pump #2 On = 74
--Pump #1 On = 73.5

-- Off = 71

-- Intake = 68
-- Floor = 67.75

B. OPERATING VOLUME:

$0.3 \cdot \pi \cdot 2.5^2 \cdot 7.48 = 211.5$

C. ABOVE ALARM VOLUME:

CYCLE TIME

1. PUMP TIME = $\frac{\text{OPERATING VOLUME}}{\text{PUMP RATE - MIN. INFLOW}}$ $\frac{211.5}{3.86 - 72} = 71$

2. FILL TIME = $\frac{\text{OPERATING VOLUME}}{\text{MINIMUM INFLOW}}$ $\frac{211.5}{72} = 30$

3. CYCLE TIME = 37

4. OVERFLOW TIME = $\frac{\text{ABOVE ALARM VOLUME}}{\text{PEAK FLOW IN}}$ $= 7$

NET POSITITVE SUCTION HEAD:

Atmospheric Head	(+)	33.9
Vapor Head	(-)	-1.0
Friction Head	(-)	
Suction or Head (+) Lift (-)		
NPSH Available		
NPSH Required		

($NPSH_A$ must be > $NPSH_R$)

SUBMERGENCE:

Elevations

WETWELL

--Top =

A. TOTAL

Project: Kennington

PUMP STATION REVIEW FORM

Date 8/8/05

Reviewed By: RSB

REQUIREMENT	REFERENCE	COMMENTS

FLOW MEASUREMENT (IF PROVIDED)

Type of measuring device mag meter to be deleted

Capacity _____ MGD Properly Sized? (Y/N) _____

CROSS-CONNECTION CONTROL

RPZ device on potable water line to pump station? no

If "No", explain prevented built into faucet assembly

Seal water system provided? (Y/N) _____

Adequately protected? (Y/N) N/A

RELIABILITY

Reliability Class II

Provision for continuous operability provided? sht. 4

Describe provision generator

Adequate? (Y/N)

Is adequate power distribution provided? (Y/N) _____ capable of running the specified pumps

Breaker settings or fuse ratings adequate? (Y/N) _____

Electrical control center locations adequate? (Y/N) _____ inside and be able to see the pump station

Are 3-phase motors adequately protected from short circuits and overloads? (Y/N) _____ check the phase that is available to the station

Low voltage protection for motors? (Y/N) _____ all pump motors

Emergency power equipment adequately located? (Y/N) _____

Adequate emergency power generator starting system? 16620 2.09.A.7 _____ battery with a trickle charge or can start three consecutive times

Alarm system provided? (Y/N) _____

Describe auto dialer

Is the alarm system adequate for the designated reliability class? (Y/N)

(Class I must monitor main power supply, auxiliary power supply, failure of each pump to discharge, and high liquid level in wet/dry wells; and be equipped with a test function and a back-up power supply. On-site audio-visual alarm required with telemetry to site manned 24 hours per day.)

(Class II/III must monitor high liquid level in wet well with on-site audio/visual alarm.)

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

December 19, 2005

James C. Pyne PhD, PE, DEE.
HRSD – Middle Peninsula
Route 33, Hartfield Village
Hartfield, VA 23071

RE: Central Garage Forcemain and
Pumping Station Design

Dear Dr. Pyne:

Please find enclosed a set of revised design calculations, plans and specifications for your review and approval for the Central Garage Forcemain and Pumping Stations.

Also, please find enclosed a summary of responses to your comments dated 10/03/05.

Please contact me with any questions that you may have regarding this submission at (804) 200-6393.

Sincerely,

Timmons Group

Ignatius Mutoti, PhD, P.E.
Process Engineer

Enclosures

cc: Reed Barrows (w/encl.)
Frank Pleva (w/encl.)
Charles Reidlinger (w/encl.)
Terry Cave (w/encl.)

1001 Boulders Parkway, Suite 300 | Richmond, Virginia 23225
TEL 804.200.6500 FAX 804.560.1016
www.timmons.com

HRSD COMMENT RESPONSES:

1. Timmons Group has includes a revised set of Design Calculations, with hydraulic grade lines, per comment by King William County.

2. Timmons Group has included a Bioxide System for Odor Control. Bioxide will be added to the forcemain at the Kennington Pump Station:
    a. The dose rate is sufficient to control odor generated, and is based on potential hydrogen sulfide formation in the forcemain with no residual nitrate expected.
    b. Bioxide is calcium nitrate and does not have adverse impacts on downstream processes or nutrient discharge limits.

3. A Pressure Control Valve has been added to the forcemain at the wastewater treatment plant (Sheet 8.11)

4. All Air Release valves have been eliminated from the Forcemain, except one (1) located at the highest point in the forcemain.

5. The required pump horse power has been revised up due to the addition of the Pressure Control valve

6. A Pressure Control valve bypass has also been included.

7. A Pressure Relief Valve has been include at the kenning Pump Station to act as a secondary back in case the Pressure control valve fails closed.

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

TRANSMITTAL

TO: Mr. Reed Barrows
DEQ
4949-A Cox Road
Glen Allen, VA 23060

Date: 12/19/2005 Job #: 21776/21795
Project: Kennington/Central Crossing
Reference:
Copies Sent To:

☐ ENCLOSED PLEASE FIND:
☐ WE ARE SENDING UNDER SEPARATE COVER:

COPIES	DATE	NUMBER	DESCRIPTION
3			Kennington Plans
1			Kennington Specs
3			Central Crossing Plans
1			Central Crossing Specs
1			Design Calcuations for Kennington/Central Crossing
1	12/19/05		Letter to HRSD

THESE ITEMS ARE TRANSMITTED:
If enclosures are not as noted, please notify us at once.

COMMENTS:

SIGNED:
Ignatius Mutoti, PhD, PE
Process Engineer

12/19/05

1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016
Site Development | Residential | Infrastructure | Technology
www.timmons.com

TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

TRANSMITTAL

TO: Reed Barrows

Date: 7/11/2005 Job #: _____

Project: _____

Reference: _____

Copies Sent To: _____

☐ ENCLOSED PLEASE FIND:
☐ WE ARE SENDING UNDER SEPARATE COVER:

COPIES	DATE	NUMBER	DESCRIPTION
1			Kennington Dwgs
1			Central Crossing Dwgs

THESE ITEMS ARE TRANSMITTED:
If enclosures are not as noted, please notify us at once.

RECEIVED
JUL 2005
PRO

COMMENTS:

Reed,

These are the drawings we were short for the above projects

Thanks

RECEIVED
JUL 12 2005
PRO

SIGNED: _____

7/11/05

1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016
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Site Development | Residential | Infrastructure | Technology

Pump Station Design

Kennington Pump Station Design: ALL Pump Stations Running

Data source: WaterCAD model

Pump Station Name					**Kennington**
Location					King William County
Grade Elevation		86	ft		
Hundred-Year Flood Elev.:		85	ft		
Average Flow		154.4	gpm		
Peak Factor		2.5			
Peak Flow		386	WaterCAD® Uses		**393 gpm**
Pump Station Peak Flow		526	gpm		
Pump Station Size		0.222	MGD		
Pump Station Capacity		0.556	MGD		
Static Head:		**97.00**	ft		
High Point Elevation:		168	ft		
Pump Off Elevation:		71	ft		
Friction Headloss		**117.9**	ft		

Junction	**Diameter**	**Flow**	**Forcemain Length**	**Headloss**	**Total Friction Headloss**
	(in)	**gpm**	**ft**	**ft/ft**	**ft**
Pump Station Losses	4	393	150	0.0037	0.56
KN to J-14	7.9	393	10,517	0.0037	38.9
J-14 to J-17	7.9	665	1,675	0.0099	15.6
J-17 to WWTP	9.7	760	13,587	0.0047	62.9
Total Forcemain Length (ft) at 393 gpm			**25,779**	0.0046	**117.9**
Total Dynamic Head		**214.93**	ft		

Equivalent Forcemain Diameter	9.7	Inches
C- Factor	125	Typical 130, Lower C used to account for fitting loses
Head Loss at 386 gpm	0.00133	ft/ft
Equivalent Velocity in Force Main	1.68	ft/s
Force main Equivalent Length	88,750	ft (Includes pump Station/Appurtenance Headlosses

Kennington System Head Curve: All Pump Stations ON

Flow (gpm)	Static Head (ft)	Friction Losses (ft)	TDH (ft)	Velocity (fps)
0	97.0	0.00	97.0	0.00
50	97.0	2.69	99.7	0.22
100	97.0	9.69	106.7	0.43
200	97.0	34.94	131.9	0.87
300	97.0	73.98	171.0	1.30
400	97.0	125.96	223.0	1.74
500	97.0	190.34	287.3	2.17
600	97.0	266.70	363.7	2.61
700	97.0	354.71	451.7	3.04

Kennington Pump Station Only Running

Data source: WaterCAD model

Pump Station Name		**Kennington**			
Location		King William County			
Grade Elevation		86	ft		
Hundred-Year Flood Elev.:		85	ft		
Average Flow		200.4	gpm		
Peak Factor		2.5			
Peak Flow		501	WaterCAD® Uses	**501**	**gpm**
Pump Station Peak Flow		526	gpm		
Pump Station Size		0.289	MGD		
Pump Station Capacity		0.721	MGD		
Static Head:		**97.00**	ft		
High Point Elevation:		168	ft		
Pump Off Elevation:		71	ft		
Total Friction Head		99.8	ft		
Junction	**Diameter**	**Flow**	**Forcemain Length**	**Headloss**	**Total Friction Headloss**
	(in)	**gpm**	**ft**	**ft/ft**	**ft**
Pump Station Losses	4	501	150	0.1602	0.87
KN to J-14	7.9	501	10,517	0.0058	60.98
J-14 to J-17	7.9	501	1,675	0.0058	8.94
J-17 to WWTP	9.7	501	13,587	0.0022	29.02
Total Forcemain Length (ft) at 393 gpm			**25,779**	0.0039	**99.8**
Total Dynamic Head		**196.81**	ft		
Equivalent Forcemain Diameter		9.7	inches		
C- Factor		125	Typical 130, Lower C used to account for fitting loses		
Head Loss at 501 gpm		0.00215	ft/ft		
Equivalent Velocity in Forcemain		2.18	ft/s		
Force main Equivalent Length		46,367	ft (Includes pump Station/Appurtenances Headlosses)		

Wastewater Pump Station Calculations

Project: Kennington
Project No: 21776

Prepared by: Al and Doc
Prepared on: April 25,2005
Date Revised: _____

Pump Station Capacity

Description	Value	Units	Notes
Average Daily Flowrate	0.222	MGD	
Calculated Sewer Peak Factor	4.68		Based on $Q_p = 3.5(Q_{ave})^{-0.1}$
Calculated Peak Hour Factor	3.55		Based on $\frac{18 + \sqrt{P}}{4 + \sqrt{P}}$ (p=pop. in 1000s)
Calculated Peak Capacity	1.500	MGD	
Peak Factor Used	2.50		
Design Flowrate	386	gpm	

Wet Well Sizing

Description	Value	Units	Notes
Wetwell Diameter	12.00	feet	
Minimum Pump Cycle	16	min	
Unit Volume	846	gal/ft	
Wet Well Drawdown Volume	1,544	gal	Based on $V = \frac{TP}{4}$
Minimum Flowrate (VFD Operation)	386	gpm	
Minimum Operating Depth	1.83	ft	

Control Settings

100-year Flood Plain Elevation	n/a	ft	From FEMA Maps
Top of Wet Well	86.00	ft	From Site Survey
Lowest Invert In	75.00	ft	1 feet of safety included
High Level Alarm	74.50	ft	0.50' Below Influent Line
Lag Pump On	74.00	ft	0.50' Below High Level Alarm
Lead Pump On	73.50	ft	0.50' Below Lag Pump On
Both Pumps Off	71.00	ft	2.50' Below Both Pump Off
Pump entrance diameter	6.00	inches	
Minimum Submergence	1.76	ft	H.I. Stds: $S=(1+2.3F)D$ where $F=v(gD)^{-0.5}$
Suction Entrance Elevation	68.75	ft	2.25' Below Both Pump Off
Wetwell Floor	67.75	ft	12" Below Suction Entrance
Depth of Wet Well	18.25	ft	

Pump Station Head Loss - Discharge Side

Description	Value	Units	Notes
Pump Station Pipe Diameter	8	inch	
Pump Station Pipe "c" value	120		(Hazen-Williams)
Equivalent Length of Fittings	149.43	ft	From Fitting Friction Loss Table at Right
Straight Pipe Quantity	15	ft	
Total Equivalent Length	164.43	ft	
Pump Station Head Loss	0.60	ft	

Printed: 12/9/2005
Kennington - FLYGT

Kennington Only System Head Curve

Flow (gpm)	Static Head (ft)	Friction Losses (ft)	TDH (ft)	Velocity (fps)
0	97.0	0.00	97.0	0.00
50	97.0	1.40	98.4	0.22
100	97.0	5.06	102.1	0.43
200	97.0	18.25	115.3	0.87
300	97.0	38.65	135.6	1.30
400	97.0	65.81	162.8	1.74
501	97.0	99.81	196.8	2.18
600	97.0	139.33	236.3	2.61
700	97.0	185.31	282.3	3.04

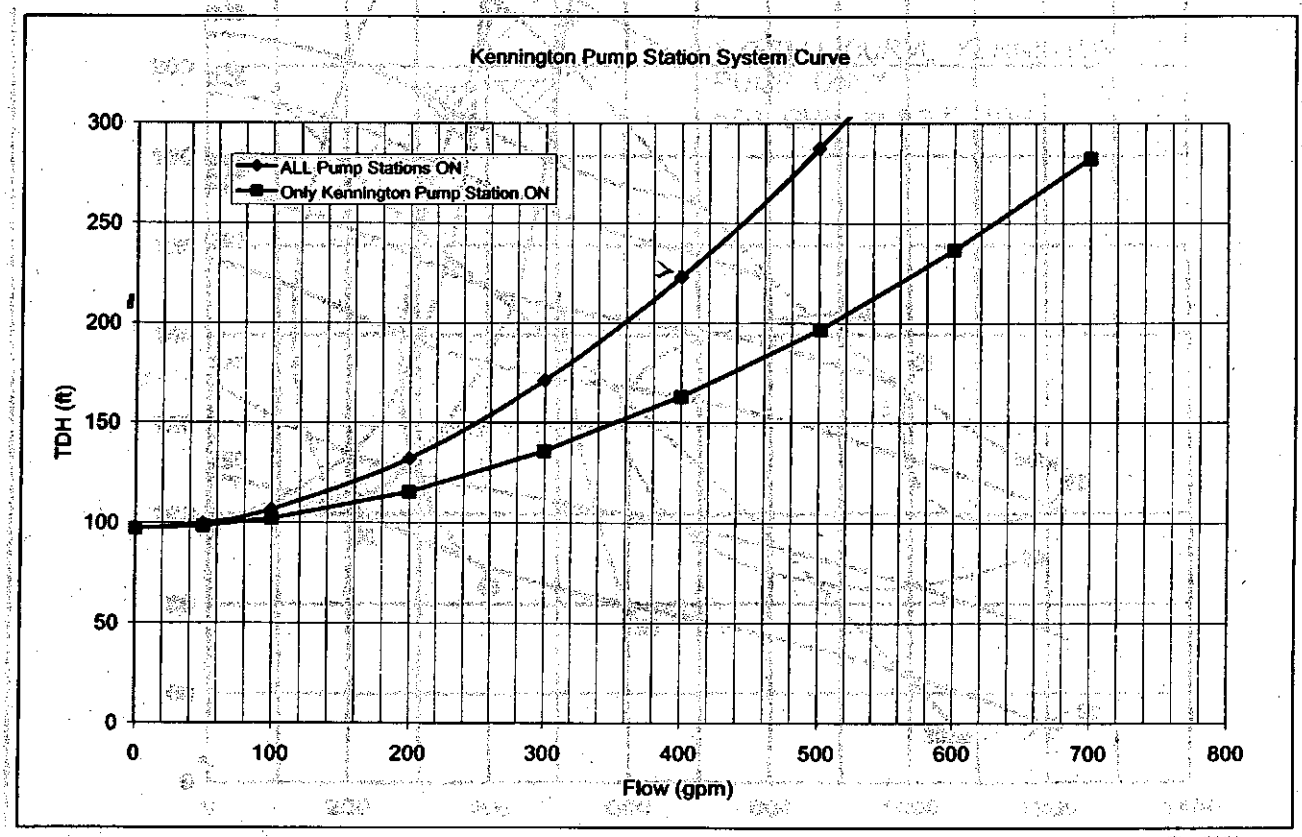

Figure 1 Kennington System Head Curves

The Pump will operate at **393 gpm** vs. **214.93** feet TDH

to **501** gpm vs. **196.81** ft TDH.

Powered by a **60 HP Electric** motor.